Remarks

The Office Action mailed on June 26, 2004 has been reviewed along with the references cited therein. In the subject Office Action, the Examiner rejected claims 1-4, 6-12, and 14 under §102(e) as being unpatentable over Roberts et al. (U.S. Patent No. 6,335,548 B1). The Examiner also rejected Claim 13 under §103(a) as being unpatentable over Roberts et al. (U.S. Patent No. 6,335,548 B1) in view of Arndt (U.S. Patent No. 6,376,902 B1).

In this response Applicants present an amendment and clarifying remarks believed to overcome the Examiner's rejections and place the claims in condition for allowance.

6,335,548, Roberts discloses many embodiments. However, none of the embodiments actually teaches to replace ALL wire bonds by solder bridges. Please see Figures 2, 3, 5, 6, 10, 11, 13, 16a, 19a, and 19b; the section titled "METHOD OF MANUFACTURING THE INVENTION" (Columns 25-26); and the section titled "EXAMPLE" (Columns 27-28).

In the section so-titled "ALTERNATIVE EMBODIMENTS", Roberts has failed to suggest replacing ALL wire bonds by solder bridges. Please see Lines 2+, Column 29. "By varying the number of electrical leads 205, the orientation of the electrical leads, employing different lead bend configurations, varying the size, shape, and orientation of the heat extraction member 204, using multiple emitters 202 of various types, and varying the encapsulant configuration 203 it is possible to configure the present invention for use in a side-looker configuration, end-looker configuration and as a through-hole device or surface-mount device." Further examples that Roberts continues to employ a wire bond include the following.

1) Lines 59-61, Column 12. "The remaining one or more isolated electrical leads 210 is not connected to heat extraction member 204".
2) "In some embodiments of the present invention, replacing integral electrical lead 209 with an isolated electrical lead electrically connected to the heat extraction member by a wire bond increases this thermal resistance". (Line

66, Column 12, to Line 3, Column 13)

3) "If one of the electrical leads 205 of an embodiment is an integral electrical lead 209, and the semiconductor radiation emitter 202 is of the type including an electrical contact at its base, then the polarity of this lead 209 is typically configured to match that of the contact at the base of the semiconductor radiation emitter 202. In this case, at least one isolated electrical lead 210 with electrical polarity opposite of that of the integral electrical lead 209 is included in the package and is electrically connected to the top bond pad of the semiconductor radiation emitter 202 via a wire bond 211". (Lines 52-62, Column 13)
4) "The use of two isolated anodic electrical leads 210 facilitates the use of two different semiconductor optical radiation emitters 202 by providing connection for an independent current supply for each emitter". (Lines 19-23, Column 14)
5) "Isolated electrical leads 210 are positioned external to the outer perimeter of the heat extraction member 204 and do not pass through the heat extraction member. The positioning of the isolated electrical leads 210 outside the outer perimeter of the heat extraction member 204 eliminates the need for insulating sleeves, bushings, and the like which are required for some prior art devices where electrical leads may penetrate through a heat extractor and thus must be electrically insulated from this extractor. Eliminating such an insulating bushing, sleeve, or the like reduces the number of components in the present invention relative to these prior art devices and thus may facilitate a more simple and cost effective manufacturing process than previously achievable for a high power LED device of comparable performance". (Line 56+, Column 14)
6) "Commonly, the metalized bond pad 502 is an anode optimized for electrically continuous connection to a metallic anode wire by means of a ball wirebond 503 and 211. The conductive base of many LED chips is commonly the cathode, optimized for electrically continuous connection to a leadframe 201 by means of a die-attach 505. In some types of LEDs, the polarity is reversed such that the top bond pad 502 is the cathode and the conductive base is the anode. In another configuration, the topmost surface of the LED

chip possesses two bondpads, and electrical connection to both the LED anode and cathode is made by wirebond 211". (Lines 40-51, Column 16)

7) "Increasing the base area of the LED chip 202 also increases the area of adhesion in the adhesive or solder bond between the LED chip and the heat extraction member 204. Such a larger bond area is stronger and more resistant to transient thermo-mechanical stress and accumulated fatigue from repeated thermo-mechanically induced stresses. Finally, increasing the base area of the LED chip 202 and the attendant contact area of the adhesive or solder bond 505 between the chip 202 and the heat extraction member 204 also may reduce the electrical resistance of the bond between the LED chip 202 and the heat extraction member 204. This is important for those LED chips constructed with cathodic or anodic contacts at the base surface. Reduced contact resistance through such base electrodes reduces excess ohmic power dissipation in the electrically conductive bond at elevated current levels. This allows the chip to maintain a cooler operating temperature for a given power dissipation (or alternately to maintain an equivalent operating temperature at higher power dissipation or higher ambient temperatures)". (Lines 27-46, Column 18)

8) "Electrical connection to top-side anode or cathode bond pads is normally made by a wire bond 211 that establishes electrical continuity between the top side electrode and an electrical lead 205, as well known in the art and described hereinafter. In alternate embodiments described hereinafter, this top-side wire bond 211 may be made in a chain fashion to the anode or cathode of another of a plurality of LED chips situated within a single LED device of the present invention. The wire bond 211 is of typical construction well known in the prior art LED devices, with the exception of size in the highest power embodiments". (Line 66+, Column 18)

9) "Wire bond 211 is included in most typical embodiments of the invention where the anode, cathode or both electrodes of a LED chip 202 consist of a metalized bond pad 502 on the top of the chip. As described hereinbefore, the primary function of a wire bond 211 in the present invention is to establish electrical contact between an LED electrode and an appropriate electrical

lead 205. The wire bond 211 and bond pad 502 must collectively establish a low electrical resistance path through which all of the current supplied to typical LED chips must flow". (Lines 10-19, Column 19)

Roberts has failed to enablingly suggest replacing ALL wire bonds by solder bridges in constructing a flip-chip LED. Roberts has briefly disclosed that "to utilize a flip-chip LED in the present invention, an additional isolation layer, such as a patterned metallized ceramic member may be used between the flip-chip and the heat extraction member to ensure electrical isolation between the LED anode and cathode". (Lines 15-36, Column 20)

In teaching how to construct the flip-chip LED, Roberts simply states that a so-called "flip-chip adapter" must be used. All that Roberts has disclosed is literally the following, which is sketchy and hardly enables a skilled artisan to build a real-world device. "A flip-chip adapter for use in the present invention consists of a small and thin, thermally conducting, electrically-insulating substrate upon which two electrically-isolated, electrically-conductive bond pads are disposed. The flip chip adapter serves several functions: 1) support a flip-chip LED; 2) provide means for electrical connection to the flip-chip anode and cathode contacts; 3) maintain electrical isolation between flip-chip anode and cathode contacts upon attachment of the flip-chip LED to the adapter and of the adapter to the heat extraction member; and 4) provide an efficient thermal path between the flip chip LED and the heat extraction member". (Lines 37-49, Column 20). If the skilled artisan were to determine how the Robert "flip-chip adapter" were to be designed, it would not resemble Applicants claimed device wherein a contiguous anode lead and a contiguous cathode lead are solder bonded to a circuit board at one end and to a die at an opposed end.

With respect to new Claim 15, a wire bond free flop-chip arrangement (side-by-side) is claimed. Roberts has never disclosed or suggested a flop-chip LED as defined in Claim 15. Furthermore, the combination of Roberts and Ardnt does not help. Arndt does not teach, suggest, or motivate a flop-chip LED which is free of wire bond.

Re: Claims 2-4, 6-10, and 12-14

As direct or indirect dependent claims from Claim 1, Claims 2-4, 5-10, and 12-14 are at least equally patentable as Claim 1.

In view of the above, it is submitted that claims 1-4, 6-10 and 12-14 patentably distinguish over the prior arts. The Applicant respectfully requests an early indication of allowance of the application.

Respectfully submitted,

FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP

Scott A. McCollister, Reg. No. 33,961
1100 Superior Avenue, 7th Floor
Cleveland, Ohio 44114-2579
(216) 861-5582

N:\GLOZ\200217\GXW0000064V001.doc